MATHS

BOOKS - DISHA PUBLICATION MATHS (HINGLISH)

RELATIONS AND FUNCTIONS-2

Jee Main 5 Years At A Glance

1. Let R be a relation on N defined by $R = \{(x, y) : 2x + y = 10\}$, then domain of R is

A. Both R_1 and R_2 are transitive relations

B. Both R_1 and R_2 are symmetric relations

C. Range of R_2 is {1,2,3,4}

D. Range of R_1 is {2,4,8}

Answer: C

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2. The function $f: R \to \left[-\frac{1}{2}, \frac{1}{2}\right]$ defined as $f(x) = \frac{x}{1+x^2}$ is

A. neither injective nor surjective

B. invertible

C. injective but not surjective

D. surjective but not injective

Answer: D

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3. The function $f: N \to N$ defined by $f(x) = x - 5\left[\frac{x}{5}\right]$ where N is a set of natural numbers, then

A. one-one and onto.

B. one-one but not onto.

C. onto but not one-one

D. neither one-one nor onto.

Answer: D

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4. let $f(x) = 2^{10}x + 1$ and $g(x) = 3^{10}x + 1$. If $fog(x) = x$, then x is equal to

A. $\frac{3^{10} - 1}{3^{10} - 2^{10}}$

B. $\frac{2^{10} - 1}{2^{10} - 3^{10}}$

C. $\frac{1 - 3^{10}}{2^{10} - 3^{10}}$

D. $\frac{1 - 2^{10}}{3^{10} - 2^{10}}$

Answer: D

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5. For $x \in R, x \neq 0, 1,$ let $f_0(x) = \frac{1}{1-x}$ and $f_{n+1}(x) = f_0(f_n(x)), n = 0, 1, 2. \ldots.$ Then the value of

$f_{100} + f_1\left(\frac{2}{3}\right) + f_2\left(\frac{3}{2}\right)$ is equal to

A. $\frac{8}{3}$

B. $\frac{4}{3}$

C. $\frac{5}{3}$

D. $\frac{1}{3}$

Answer: C

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6. Let $A = \{x_1, x_2, x_3 \ldots., x_7\}, B = \{y_1 y_2 y_3\}$. The total number of functions $f: A \to B$ that are onto and ther are exactly three elements x in A such that $f(x) = y_2$, is equal to

A. $14^7 C_3$

B. 16^7C_3

C. 14^7C_2

D. 12^7C_2

Answer: A

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7. If g is the inverse of a function f and $f'(x) = \frac{1}{1+x^5}$, then g'(x) is equal to

A. $\frac{1}{1+\{g(x)\}^5}$

B. $1+\{g(x)\}^5$

C. $1+x^5$

D. $5x^4$

Answer: B

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8. Let P be the relation defined on the set of all real numbers such that $P = \{(a, b) : \sec^2 a - \tan^2 b = 1\}$. Then P is

A. reflexive and symmetric but not transitive.

B. reflexive and transitive but not symmetric.

C. symmetric and transitive but not reflexive

D. an equivalence relation.

Answer: D

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Exercise 1 Concept Builder Topicwise Topic 1 Types Of Relations Inverse Of A Relation

1. Prove that a relation R on a set A is symmetric iff $R = R^{-1}$.

A. Reflexive

B. Symmetric

C. Transitive

D. None of these

Answer: B

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2. If R is an equivalence relation on a set A, then R^{-1} is A. reflexive only B. symmetric but not transitive C. equivalence D. None of these

A. Reflexive only

B. Symmetric but not transitive

C. Equivalence

D. None of these

Answer: C

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3. R is a relation from {11, 12, 13} to {8, 10, 12} defined by $y = x - 3$. Then, R^{-1} is (a) {(8, 11), (10, 13)} (b) {(11, 8), (13, 10)} (c) {(10, 13), (8, 11), (8, 10)} (d) none of these

A. {(11,8), (13, 10)}

B. {(8, 11), (10, 13)}

C. {8,11), (9, 12), (10, 13)}

D. None of these

Answer: B

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4. The relation R is defined on the set of natural numbers as {(a,b): a = 2b}, the R^{-1} is given by

A. {(2,1),(4,2), (6,3).....}

B. {(1,2), (2,4),(3,6).....}

C. R^{-1} is not defined

D. None of these

Answer: B

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5. Let $R = \{(x, y) : x^2 + y^2 = 1, x, y \in R\}$ be a relation in R. Then the relation R is

A. Reflexive

B. Symmetric

C. Transitive

D. Anti-symmetric

Answer: B

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6. Let S be the set of all real numbers. Then the relation $R = \{(a, b) : 1 + ab > 0\}$ on S is

A. Reflexive and symmetric but not transitive

B. Reflexive and transitive but not symmetric

C. Symmetric, transitive but not reflexive

D. Reflexive, transitive and symmetric

Answer: A

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7. Let R be a relation on the set N be defined by $\{(x, y) \mid x, y \varepsilon N, 2x + y = 41\}$. Then prove that the R is neither reflexive nor symmetric and nor transitive.

A. Reflexive

B. Symmetric

C. Transitive

D. None of these

Answer: D

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8. Let R and S be two non-void relations on a set A. Which of the following statements is false?

A. R and S transitive $\Rightarrow R \cup S$ is transitive

B. R and S transitive $\Rightarrow R \cap S$ is transitive

C. R and S symmetric $\Rightarrow R \cup S$ symmetric

D. R and S reflexive $\Rightarrow R \cup S$ reflexive

Answer: A

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9. Determine whether Relation R on the set Z of all integer defined as $R = \{(x,\ y) : y$ is divisible by $x\}$

A. Reflexive

B. Symmetric

C. Transitive

D. an equivalence relation

Answer: D

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10. Show that the relation R in the set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a b| is divisible by 2} is an equivalence relation. Write all the quivalence classes of R.

A. 5

B. 2

C. 3

D. 4

Answer: A

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11. On the set N of all natural numbers define the rational R by aRb iff the G.C.D. of a and b is 2. Then R is

A. reflexive, but not symmetric

B. symmetric only

C. reflexive and transitive

D. not reflexive, not symmetric, not transitive

Answer: B

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12. Let $A = \{1, 2, 3\}$ Then number of relations containing $(1, 2) and (1, 3)$ which are reflexive and symmetric but not transitive is (A) 1 (B) 2 (C) 3 (D) 4

A. 1

B. 2

C. 3

D. 4

Answer: A

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13. Let R be a relation over the set $N \times N$ and it is defined by $(a, b)R(c, d) \Rightarrow a + d = b + c$. Then R is

A. Reflexive only

B. Symmetric only

C. Transitive only

D. An equivalence relation

Answer: D

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14. Which of one of the following relations on R is equivalence relation

A. $aR_1b \Leftrightarrow |a| = |b|$

B. $aR_2b \Leftrightarrow a \geq b$

C. $aR_3b \Leftrightarrow a$ divides b

D. $aR_4b \Leftrightarrow a < b$

Answer: A

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Exercise 1 Concept Builder Topicwise Topic 2 Mappings Mapping Of Functions Kinds Of Mapping Of Functions

1. Let $f: R, \overrightarrow{R}\, where f(x) = \frac{x^2 + 4x + 7}{x^2 + x + 1}$. Is $f(x) one one?$

A. one-one

B. many-one

C. one-manu

D. None of these

Answer: B

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2. The set of parameter 'a' for which the functions $f: R \to R$ defined by $f(x) = ax + \sin x$ is bijective, is

A. $[-2\infty]$

B. $(-\infty - 1] \cup [1, \infty)$

C. $(-\infty, -2) \cup [2/3, 8)$

D. $[-2, 2/3]$

Answer: B

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3. If $A = \{1, 3, 5, 7\}$ and $B = \{1, 2, 3, 4, 5, 6, 7, 8\}$, then the number of one-to-one functions from A into B is

A. 1340

B. 1680

C. 1430

D. 1880

Answer: B

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4. Which of the following is one-one function ?

A. e^x

B. e^{x^2}

C. $\sin x$

D. None of these

Answer: A

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5. $f: X \to Y$ is onto, if and only if

1. range of $f = Y$

2. range of $f \neq Y$

3. range of $f < Y$

4. range of $f \geq Y$

A. range of f=Y

B. range of $f \neq Y$

C. range of $f < Y$

D. range of $f \geq Y$

Answer: A

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6. Let $A = \{1, 2, \ldots, n\}$ and $B = \{a, b\}$. Then number of subjections from A into B is nP2 (b) $2^n - 2$ (c) $2^n - 1$ (d) nC2

A. ap_2

B. $2^n - 2$

C. $2^n - 1$

D. None of these

Answer: B

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7. Let $f: R \to R$ be function defined by $f(x) = \sin(2x - 3)$, then f is

A. injective

B. surjective

C. bijective

D. None of these

Answer: D

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8. On the set of integers Z, define f : $Z \to Z$ as

$$f(n) = \begin{cases} \frac{n}{2}, & \text{n is even.} \\ 0, & \text{n is odd.} \end{cases}$$

Then, f is

A. injective but not surjective

B. neither injective nor surjectives

C. surjective but not injective

D. bijective

Answer: C

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9. If the function $f: R\overrightarrow{A}$ given by $f(x) = \frac{x^2}{x^2+1}$ is surjection, then find A.

A. [0,1)

B. (0,1)

C. (0,1]

D. [0,1]

Answer: A

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10. If $f: R \to R$ be a function such that $f(x) = \{x|x| - 4; x \in Q, x|x| - \sqrt{3}; x \notin Q$ then f(x) is

A. one to one and onto

B. many to one and onto

C. one to one and into

D. many to one and into

Answer: D

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11. Consider functions f and g such that composite gof is defined and is one-one.Are f and g both necessarily one-one.

A. neither fnor g is one-one

B. f and g both are necessarily one-one

C. g must be one-one

D. None of the above

Answer: D

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12. If $f(x) = |x - 2|$, where x is a real number, then, which one of the followin is correct?

A. f is Periodic

B. $f(x + y) = f(x) + f(y)$

C. f is an odd function

D. f is not a one- one function

Answer: D

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13. Let f : R - {n} $\rightarrow$ R be a function defined by $f(x) = \frac{x-m}{x-n}$, where $m \neq n$. Then,

A. f is one-one onto

B. f is one-one into

C. f is many-one onto

D. f is many one into

Answer: B

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14. The function $f: R \rightarrow R$ is defined by $f(x) = (x-1)(x-2)(x-3)$ is

A. one-one but not onto

B. onto but not one-one

C. both one-one and onto

D. neither one-one nor onto

Answer: B

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15. Let $A = \{1, 2, 3)$ and $B = \{a, b, c\}$, and $f = \{(1, a), (2, b), (P, c)\}$ be a function from A to B. For the function f to be one-one and onto the value of P =

A. 1

B. 2

C. 3

D. 4

Answer: C

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16. A function $f: X \to Y$ is said to be onto, if for every $y \in Y$ there exists an element x in X such that

A. f(x)=y

B. f(y)=0

C. f(x)+y=0

D. f(y)+x=0

Answer: A

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17. Let f be a one-one function with domain $\{x, y, z\}$ and range $\{1, 2, 3\}$. It is given that exactly one of the following statements is true and the remaining two are false $f(X) = 1, f(y) \neq 1 f(z) \neq 2$ determine $f^{-1}(1)$

A. $f(x) > f(y) > f(z)$

B. $f(x) < f(y) < f(z)$

C. $f(y) < f(x) < f(z)$

D. $f(y) < f(z) < f(x)$

Answer: C

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18. The mapping f : $N \to N$ given by $f(n) = 1 + n^2, n \in N$, where N is the set of natural numbers, is

A. one-one and onto

B. onto but not one-one

C. one-one but not onto

D. neither one-one nor onto

Answer: C

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19. The function $f: R \to R$ given by $f(x) = x^2 + x$ is

A. one-one

B. onto

C. many-one

D. None of the above

Answer: C

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Exercise 1 Concept Builder Topicwise Topic 3 Composite Function And Relation Inverse Of A Function Binary Operations

1. If $f(x) = \frac{x}{\sqrt{1+x^2}}$ then $fofof(x)$

A. $\frac{3x}{\sqrt{1+x^2}}$

B. $\frac{x}{\sqrt{1+3x^2}}$

C. $\frac{3x}{\sqrt{1-x^2}}$

D. None of these

Answer: B

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2. If $f(x) = |x|$ and $g(x) = [x]$ then value of fog $\left(-\frac{1}{4}\right) + gof\left(-\frac{1}{4}\right)$ is

A. 0

B. 1

C. -1

D. $1/4$

Answer: B

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3. The inverse of the function $\frac{10^x - 10^{-x}}{10^x + 10^{-x}}$ is

A. $\frac{1}{3}\log_{10}\frac{1+x}{1-x}$

B. $\frac{1}{2}\log_{10}\frac{2+3x}{2-3x}$

C. $\frac{1}{3}\log_{10}\frac{2+3x}{2-3x}$

D. $\frac{1}{6}\log_{10}\frac{2-3x}{2+3x}$

Answer: B

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4. Let $f:[4,\infty)\to[4,\infty)$ be defined by $f(x)=5^{x^{(x-4)}}$.Then $f^{-1}(x)$ is

A. $2-\sqrt{4+\log_5 x}$

B. $2+\sqrt{3+\log_5 x}$

C. $\left(\frac{1}{5}\right)^{x(x-4)}$

D. None of these

Answer: B

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5. If the binary operation * on the set of integers Z, is defined by $a \cdot b = a + 3b^2$, then find the value of $2 \cdot 4$

A. 32

B. 40

C. 36

D. 35

Answer: D

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6. If $R \subset A \times B$ and $S \subset B \times C$ be two relations, then $(SoR)^{-1} =$

A. $S^{-1}oR^{-1}$

B. RoS

C. $R^{-1}oS^{-1}$

D. None of these

Answer: C

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7. The binary operation * defined on N by $a \cdot b = a + b + ab$ for all $a,\ b \in N$ is (a) commutative only (b) associative only (c) commutative and associative both (d) none of these

A. commutative only

B. associative only

C. both commutative and associative

D. None of these

Answer: C

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8. If $f: R \to R, g: R \to R$ and $h: R \to R$ is such that $f(x) = x^2, g(x) = \tan x$ and $h(x) = \log x$ then the value of $[ho(gof)]x$, if $x = \frac{\sqrt{\pi}}{2}$ will be

A. 0

B. 1

C. -1

D. 10

Answer: A

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9. Let $f: \left[-\frac{\pi}{3}, \frac{2\pi}{3}\right] \overrightarrow{0, 4}$ be a function defined as $f(x) = \sqrt{3}\sin x - \cos x + 2$. Then $f^{-1}(x)$ is given by $\sin^{-1}\left(\frac{x-2}{2}\right) - \frac{\pi}{6}$ $\sin^{-1}\left(\frac{x-2}{2}\right) + \frac{\pi}{6}$ $\frac{2\pi}{3} + \cos^{-1}\left(\frac{x-2}{2}\right)$ (d) none of these

A. $\sin\left(\frac{x-2}{2}\right) - \frac{\pi}{6}$

B. $\sin\left(\frac{x-2}{2}\right) + \frac{\pi}{6}$

C. $\frac{2\pi}{3} + \cos^{-1}\left(\frac{x-2}{2}\right)$

D. None of these

Answer: B

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10. If $f(x) = 1 + x + x^2 + x^3 + \ldots. \infty$ for $|x| < 1$ then $f^{-1}(x) =$

A. $\frac{x}{1+x}$

B. $\frac{x}{1-x}$

C. $\frac{1-x}{x}$

D. $\frac{1}{x}$

Answer: B

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11. Let f be a function with domain X and range Y. Let $A, B \subseteq X$ and $C, D \subseteq Y$ Which of the following is not true?

A. $f(A \cup B) = f(A) \cup f(B)$

B. $f(A \cap B) = f(A) \cap f(B)$

C. $f^{-1}(C \cup D) = f^{-1}(C) \cup f^{-1}(D)$

D. $f^{-1}(C \cap D) = f^{-1}(C) \cap f^{-1}(D)$

Answer: B

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12. If a binary operation * is defined by $a \cdot b = a^2 + b^2 + ab + 1$, then $(2 \cdot 3) \cdot 2$ is equal to (a) 20 (b) 40 (c) 400 (d) 445

A. 20

B. 40

C. 400

D. 445

Answer: D

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13. A binary operation * on the set {0,1,2,3,4,5} is defined as: $a \cdot b = \{a + ba + b - 6\backslash\backslash\backslash\backslash \text{if}\backslash \ \ a + b < 6\backslash\backslash\backslash \text{if}\, a + b \geq 6$ Show that zero is the identity for this operation and each element a of the set is invertible with 6a, being the inverse of a.

A. 0

B. 1

C. 2

D. 3

Answer: A

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14. Let * be a binary operation on N given by $a \cdot b = HCF\,(a,\ b),\ \ a,\ b \in N$. Write the value of $22 \cdot 4$.

A. 1

B. 2

C. 3

D. 4

Answer: B

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15. Show that the total number of binary operation from set A to A is n^{n^2}.

A. n^{n^2}

B. n^n

C. 2^{n^2}

D. n^2

Answer: A

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16. If $fQ \to Qf(x) = 2x, g, Q \to Q, g(x) = x + 2$ then value of $(fog)^{-1}(20)$ is

A. 5

B. -8

C. 4

D. 8

Answer: D

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17. If $g(x)=x-2$ is the inverse of the function $f(x)=x+2$, then graph of $g(x)$ is the image of graph of $f(x)$ about the line $y=kx$. Here $k =$

A. 1

B. 2

C. 3

D. 4

Answer: A

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18. Which of the following is not a binary operation on the indicated set?

A. On Z^+, $*$ defined by $a * b = a - b$

B. On Z^+, $*$ defined by $a * b = ab$

C. On R, $*$ defined by $a * b = ab^2$

D. None of above

Answer: A

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19. If

$f(x) = -1 + |x - 1|, \ -1 \leq x \leq 3$ and $g(x) = 2 - |x + 1|, \ -2 \leq x$

then find $fog(x)$ and $gof(x)$.

A. $\begin{cases} x + 1 & -2 \leq x \leq 0 \\ x - 1 & 0 < x \leq 2 \end{cases}$

B. $\begin{cases} x - 1 & -2 \leq x \leq 0 \\ x + 1 & 0 < x \leq 2 \end{cases}$

C. $\begin{cases} -x - 1 & -2 \leq x \leq 0 \\ x - 1 & 0 < x \leq 2 \end{cases}$

D. None of these

Answer: D

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20. Let $f(x) = \frac{ax+b}{cx+d}$. Then the fof (x) =x provided that

A. $d = -a$

B. $d = a$

C. $a = b = c = d = 1$

D. $a = b = 1$

Answer: A

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21. Let $A = \{1, 2, 3, 4, 5\}$ and functions $f: A \rightarrow$ and $g: A \rightarrow A$ to defined by $f(1) = 3, f(2) = 5, f(3) = 3, f(4) = 1, f(5) = 2, g(1) = 4$

A. fog= {(1,1), (2,3), (3, 2), (4,5)}

B. fog={(1,1),(2,3), (3,3), (4,5), (5,3)}

C. gof= {(1, 1), (2,3), (3, 3), (4,4), (5,5)}

D. gof= {(2, 2), (2,3), (3,1),(4,1),(5, 1)}

Answer: B

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22. Suppose that f is an even function, g is an odd function and both f and g are defined on the entire real line R. Which of the following wherever defined are odd function ?

A. an even function

B. an odd function

C. neither even nor odd

D. a periodic function

Answer: A

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23. If $f(x) = e^x$ and $g(x) = \log_e x$, hen which of the following is true?

A. $f\{g(x)\} = \{f(x)\}$

B. $f\{g(x)\} = g\{f(x)\}$

C. $f\{g(x)\} + g(\{f(x)\} = 0$

D. $f\{g(x)\} - g\{f(x)\} = 1$

Answer: B

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24. The inverse of the function $f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}} + 2$ is given by

A. $\log_e \left(\frac{x-3}{x-1}\right)^{1/2}$

B. $\log_e \left(\frac{x-1}{3-1}\right)^{1/2}$

C. $\log_e \left(\frac{x+2}{x-3}\right)^{1/2}$

D. $\log_e \left(\frac{x+1}{x-2}\right)^{1/2}$

Answer: B

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25. Show that if $f: R - \left\{\frac{7}{5}\right\} \to R - \left\{\frac{3}{5}\right\}$ is defined by $f(x) = \frac{3x+4}{5x-7}$ and $g: R - \left\{\frac{3}{5}\right\} \to R - \left\{\frac{7}{5}\right\}$ is define by $g(x) = \frac{7x+4}{5x-3}$, then $fog = I_A$ and $gof = I_B$, where $A = R - \left\{\frac{3}{5}\right\}, B = R - \left\{\frac{7}{5}\right\}; I_A(x) = x, \forall x \in A, I_B(x) = x, \forall x \in B$ are called ide

A. $fog = I_A$ and $gof = I_A$

B. $fog = I_A$ and $gof = I_B$

C. $fog = I_B$ and $gof = I_B$

D. $fog = I_B$ and $gofI_A$

Answer: B

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26. Let $f: R \rightarrow$ be defined by $f(x) = 3x^2 - 5$ and $g: R \rightarrow R$ by $g(x) = \frac{x}{x^2} + 1$ then gof is

A. $\frac{3x^2 - 5}{9x^4 - 30x^2 + 26}$

B. $\frac{3x^2 - 5}{9x^4 - 6x^2 + 26}$

C. $\frac{3x^2}{x^4 + 2x^2 - 4}$

D. $\frac{3x^2}{9x^4 + 30x^2 - 2}$

Answer: A

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27. Let $f(x) = \begin{cases} x^3 - 1, & x < 2 \\ x^2 + 3, & x \geq 2 \end{cases}$ Then

A. $f^{-1}(x) = \begin{cases} (x+1)^{1/3}, & x < 2 \\ (x-3)^{1/2} +, & x \geq 2 \end{cases}$

B. $f^{-1}(x) = \begin{cases} (x+1)^{1/3}, & x < 7 \\ (x-3)^{1/2} +, & x \geq 7 \end{cases}$

C. $f^{-1}(x) = \begin{cases} (x+1)^{1/3}, & x < 1 \\ (x-3)^{1/2} +, & x \geq 7 \end{cases}$

D. $f^{-1}(x)$ does not exist

Answer: B

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Exercise 2 Concept Applicator

1. If R be a relation from $A = \{1, 2, 3, 4\}$ to $B = \{1, 3, 5\} i.e.,$ $(a, b) \in R \Leftrightarrow a < b,$ then Ro R^{-1} is

A. $\{(1, 3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)\}$

B. $\{(3, 1), (5, 1), (3, 2), (5, 2), (5, 3), (5, 4)\}$

C. $\{(3, 3), (3, 5), (5, 3), (5, 5)\}$

D. $\{(3, 3), (3, 4), (4, 5)\}$

Answer: C

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2. Let r be relation from R (set of real numbers) to R defined by $r = \{(a, b) \mid a, b \in R \text{ and } a - b + \sqrt{3}$ isan irrational number}. The relation r is

A. an equivalence relation

B. reflexive only

C. symmetric only

D. transitive only

Answer: B

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3. Let R be a relation on the set of all real numbers defined by $xRy \Leftrightarrow |x-y| \leq \frac{1}{2}$ Then R is

A. reflexive and symmetric but not transitive

B. symmetric and transitive but not reflexive

C. transitive but neither reflexive nor symmetric

D. None of these

Answer: A

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4. Let $f: R \to R$ be a function defined by,$f(x)$=$\frac{e^{|x|}-e^{-x}}{e^{x}+e^{-x}}$ then

A. f is both one-one and onto

B. f is one-one but not onto

C. f is onto but not one-one

D. f is neither one-one nor onto

Answer: D

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5. If X and Y are two non-empty sets where $f: X \to Y$,is function is defined such that $f(c) = \{f(x): x \in C\}$ for $C \subseteq X$ and $f^{-1}(D) = \{x: f(x) \in D\}$ for $D \subseteq Y$,for any $A \subseteq Y$ and $B \subseteq Y$, then

A. $f(f^{-1}B)) = B$

B. $f(f^{-1}(B)) \subset B$

C. $f^{-1}(f(A)) = A$

D. $f^{-1}(f(A)) \subset A$

Answer: B

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6. Let $f(x) = \sin z$ and $g(z) = \cos z$. If denotes a composition of functions, then $(f + ig) \cdot (f - ig)$ (where $i = \sqrt{-1}$) is

A. $ie^{-e^{-iz}}$

B. $ie^{-e^{iz}}$

C. $-ie^{-e^{-iz}}$

D. None of these

Answer: B

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7. If $f: R \to R, g, R \to R$ be two funcitons, and $h(x) = 2\min\{f(x) - g(x), 0\}$ then $h(x) =$

A. $f(x) + g(x) - 1|g(x) - f(x)|$

B. $f(x) + g(x) + |g(x) - f(x)|$

C. $f(x) - g(x) + |g(x) - f(x)|$

D. $f(x) - g(x) - |g(x) - f(x)|$

Answer: B

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8. The relation R defined in $A = \{1, 2, 3\}$ by aRb if $\left|a^2 - b^2\right| \leq 5$. Which of the following is faise

A. $R = \{(1, 1), (2, 2), (3, 3), (2, 1), (1, 2), (2, 3), (3, 2)\}$

B. $R^{-1} = R$

C. Domain of R={1,2,3}

D. Range of $R = \{5\}$

Answer: D

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9. Let $R = \{(x, y) : x, y \in N \text{ and } x^2 - 4xy + 3y^2 = 0\}$, where N is the set of all natural numbers. Then the relation R is

A. reflexive but neither symmetric nor transitive

B. symmetric and transitive.

C. reflexive and symmetric

D. reflexive and transitive

Answer: D

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10. If $f(x) = \sin x + \cos x$and $g(x) = x^2 - 1$, then $g(f(x))$is invertible in the domain .

A. $\left[0, \frac{\pi}{2}\right]$

B. $\left[\frac{-\pi}{4}, \frac{\pi}{4}\right]$

C. $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

D. $[0, \pi]$

Answer: B

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11. If $f(x) = \frac{x}{x-1}$, then $(fofof \odot \ldots . . of)(x)$ is equal to

A. $\frac{x}{x-1}$

B. $\left(\frac{x}{x-1}\right)^{19}$

C. $\frac{19x}{x-1}$

D. x

Answer: A

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12. Statement-1: If $f: R \to R$ and $g: R \to R$ be two functions such that $f(x) = x^2$ and $g(x) = x^3$, then fog (x)=gof (x).

Statement-2: The composition of functions is commulative.

A. $f(x) = x^3, g(x) = x + 1$

B. $f(x) = \sqrt{x}, g(x) = \cos x$

C. $f(x) = x^m, g(x), m \neq n, m, n \in I$ (I is the st of all integers)

D. $f(x) = x - 1, g(x) = x^2 + 1$

Answer: C

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13. Which of the following functions is NOT one-one ?

1. $f: R \to R$ defined by $f(x) = 6x - 1$

2. $f: R \to R$ defined by $f(x) = x^2 + 7$

3. $f: R \to R$ defined by $f(x) = x^3$

4. $f: R - \{7\} \to R$ defined by $f(x) = \dfrac{2x + 1}{x - 7}$

A. $f: R \to R$ defined by $f(x) = 6x - 1$

B. $f: R \to R$ defined by $f(x) = x^2 + 7$

C. $f: R \to R$ defined by $f(x) = x^3$

D. $f: R - \{7\} \to R$ defined by $f(x) = \dfrac{2x+1}{x-7}$

Answer: B

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14. If $f(x) = 2x + |x|, g(x) = \dfrac{1}{3}(2x - |x|)$ and h(x)=f(g(x)), domain of $\underbrace{\sin^{-1}(h(h(h(h...h(x)...))))}_{\text{n times}}$ is

A. $[-1, 1]$

B. $\left[-1, -\dfrac{1}{2}\right] \cup \left[\dfrac{1}{2}, 1\right]$

C. $\left[-1, -\dfrac{1}{2}\right]$

D. $\left[\dfrac{1}{2}, 1\right]$

Answer: A

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15. If $f(x) = \sqrt{3|x| - x - 2}$ and $g(x) = \sin x$, then domain of $(fog)(x)$ is

A. $\left\{2n\pi + \frac{\pi}{2}\right\}, n \in I$

B. $\underset{n \in I}{\cup} \left(2n\pi + \frac{7\pi}{7}, 2n\pi + \frac{11\pi}{6}\right)$

C. $\left\{2n\pi + \frac{7\pi}{6}\right\}, n \in I$

D. $\left\{(14m +) + \frac{\pi}{2} : m \in I\right\} \underset{n \in I}{\cup} \left[2n\pi + \frac{7\pi}{7}, 2n\pi + \frac{11\pi}{6}\right]$

Answer: D

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16. Letf: $A \to B$ be a function then show that f is a bijection if and only if there exists a function $g: B \to A$ such that fog = $I_B \& gof = I_A$ & in this case g = f^{-1}

A. one-one

B. onto

C. one-one and onto

D. None of these

Answer: C

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17. Let $A = N \times N$ and $*$ be the binary opertation on A defined by $(a, b) * (c, d) = (a + c, b + d)$. Show that $*$ is commutative and associative.

A. commutative

B. associative

C. Both (a) and (b)

D. None of these

Answer: C

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18. If the binary operation $\odot$ is defined on the set Q^+ of all positive rational numbers by $a \odot b = \frac{ab}{4}$. Then, $3 \odot \left(\frac{1}{5} \odot \frac{1}{2}\right)$ is equal to $\frac{3}{160}$ (b) $\frac{5}{160}$ (c) $\frac{3}{10}$ (d) $\frac{3}{40}$

A. $\frac{3}{160}$

B. $\frac{5}{160}$

C. $\frac{3}{10}$

D. $\frac{3}{40}$

Answer: A

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19. Find the inverse of the function: $f:(-\infty,1]\overrightarrow{\frac{1}{2},\infty,where f(x)=2^{x(x-2)}}$

A. $1-\sqrt{1+\log_2 x}$

B. $\sqrt{\log_2 x}$

C. $\sqrt{\log_2 x+1}$

D. $\log_2 x^2$

Answer: A

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20. Let $f:N\to R$ be the function defined by $f(x)=\frac{2x-1}{2}$ and $g:Q\to Q$ be another function defined by $g(x)=x+2$ then $(gof)\left(\frac{3}{2}\right)$ is

A. 1

B. 0

C. $\frac{7}{2}$

D. 3

Answer: D

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21. Let $f(x) = (x+1)^2 - 1, x \geq -1.$ Then the set $\{x : f(x) = f^{-1}(x)\}$ is $\left\{0, 1, \frac{-3+i\sqrt{3}}{2}, \frac{-3-i\sqrt{3}}{2}\right\}$ (b) $\{0, 1, -1$ $\{0, 1, 1\}$ (d) $empty$

A. $\left\{0, -1, \frac{-3+I\sqrt{3}}{2}, \frac{-3-i\sqrt{3}}{2}\right\}$

B. $\{0, 1-1\}$

C. {0,-1}

D. empty

Answer: C

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22. Let $f(x) = \begin{cases} 2x + a, & x \geq -1 \\ bx^2 + 3, & x < -1 \end{cases}$

and $g(x) = \begin{cases} x + 4, & 0 \leq x \leq 4 \\ -3x - 2, & -2 < x < 0 \end{cases}$

If $a = 2$ and $b = 3$, then the range of $g(f(x))$ is

A. $a = 0, b > 5$

B. $a = 2, b > 7$

C. $a = 2, b > 10$

D. $a = 0, b \in R$

Answer: A

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23. Let $f: (4, 6) \cup (6, 8)$ be a function defined by $f(x) = x + \left[\frac{x}{2}\right]$ where [.] denotes the greatest integer function, then $f^{-1}(x)$ is equal to

A. $x - \left[\frac{x}{2}\right]$

B. $-x-2$

C. $x-2$

D. $\frac{1}{x+\left[\frac{x}{2}\right]}$

Answer: C

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24. Let [x] denot the greatest integer $\leq x$. If $f(x)=[x]$ and $g(x)=|x|$ then the value of $f\left(g\left(\frac{8}{5}\right)\right)-g\left(f\left(-\frac{8}{5}\right)\right)$ is

A. 2

B. -2

C. 1

D. -1

Answer: D

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25. Let $f(x) = ax + bandg(x) = cx + d, a \neq 0.$ Assume $a = 1, b = 2.$

If $(fog)(x) = (gof)(x)$ for all $x,$ what can you say about $candd?$

A. c and d both arbitary

B. c=1, d arbitrary

C. c arbitrary, d=1

D. c=1,d=1

Answer: B

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26. Let $f(x) = x^2 + 3x - 3, x \geq 0$ if in points $x_1, x_2, x_3, \ldots x_n$ are so chosed on the x-axis such that

(i) $\frac{1}{n}\sum_{i=1}^{n} f^{-1}(x_i) = f\left(\frac{1}{n}\sum_{i=1}^{n} x_i\right)$

(ii) $\sum_{i=1}^{n} f^{-1}(x_i) = \sum_{i=1}^{n} x_i$ wehre f^{-1} denots the inverser of f. then mean of $x_1, x_2, x_3, \ldots. x_n$ is :

A. 1

B. 2

C. 3

D. 4

Answer: A

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27. If $f: R \to R, g: R$ and $h: R \to R$ be three functions are given by $f(x) = x^2 - 1, g(x) = \sqrt{x^2 + 1}$ and $h(x) = \begin{cases} 0 & x \leq 0 \\ x & x > 0 \end{cases}$

Then the composite functions (ho fog) (x)) is given by

A. x^2

B. 0

C. x

D. None of these

Answer: A

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28. Let $g(x) = 1 + x - [x]$ and $f(x) = \begin{cases} -1, & x < 0 \\ 0, & x = 0 \\ 1, & x > 0 \end{cases}$, then for all x, $f[g(x)]$ is equal to

A. x

B. 1

C. f(x)

D. g(x)

Answer: C

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29. Which of the following functions is the inverse of itself? $f(x) = \frac{1-x}{1+x}$ (b) $f(x) = 5^{\log x}$ $f(x) = 2^{x(x-1)}$ (d) None of these

A. $f(x) = \frac{1-x}{1+x}$

B. $f(x) = 3^{\log x}$

C. $f(x) = 3^{x(x+1)}$

D. None of these

Answer: A

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30. Let $f(x) = \sin x and g(x) = (\log)_e |x|$. If the ranges of the composition functions $fogandgofareR_1 andR_2,$ respectively, then `R_1-{u :-1lt=u<1},R_2={v :-oo

A. $R_1 = \{u: -1 \leq u < 1\}, R_2 = \{v: -\infty < v < 0\}$

B. $R_1 = \{u: -\infty < u < 0\}, R_2 = \{v: -\infty < v < 0\}$

C. $R_1 = \{u: -1 < u < 1\}, R_2 = \{v: -\infty < v < 0\}$

D. $R_1 = \{u: -1 \leq u \leq 1\}, R_2 = \{v: -\infty < v \leq 0\}$

Answer: D

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